

**ILLINOIS COMMERCE COMMISSION  
DATA REQUEST**

**REQUEST NUMBERS MGM 3.01 – MGM 3.19**

Utility Company: MidAmerican Energy Company

Docket No.: 01-0444

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MGM 3.03 On Exhibit No. 4.0, page 24, Dr. Morin states, “It is well established in the academic finance literature that the CAPM produces a downward-biased estimate of equity cost for companies with a beta of less than 1.00.” Does Dr. Morin agree that this downward bias is part of the justification for using adjusted betas? If not, please explain why, in addition to an adjustment to beta, an adjustment to the CAPM formula is necessary and provide any academic finance literature to verify that position. For all such literature provided, include references to the types (e.g., raw or adjusted) of betas discussed therein.

**Response:**

There are two distinct separate issues involved when implementing the CAPM. First, given the validity of the standard CAPM, what is the best proxy for expected beta? Second, and more fundamentally, does the standard form of the CAPM provide the best explanation of the risk-return relationship observed on capital markets?

**1. Beta measurement**

Empirically, it is common knowledge that betas are estimated with measurement error. High estimated betas will tend to have positive error (overestimated) and low estimated betas will tend to have negative error (underestimated). Therefore, it is necessary to squash the estimated betas in towards 1.00. This is typically done by measuring the extent to which estimated betas tend to regress towards the mean over time. This adjustment is routinely performed by investment services such as Value Line, the most widely circulated source of investment information to investors, Merrill Lynch, and Bloomberg. In accordance with this approach and with the empirical literature which strongly supports this procedure, Dr. Morin uses the same beta adjustment procedures as the investment services by giving 2/3 weight to the measured raw beta and 1/3 weight to the prior value of 1.0 for each stock. This widely-used formula essentially pushes high betas down toward 1.0 and low betas up toward 1.0. The empirical evidence shows that the beta adjustment procedure used by investment services gives far better beta predictions than the unadjusted figures.

Unadjusted raw betas are inappropriate to use in a CAPM analysis. The raw unadjusted beta is not the appropriate measure of market risk to use. Current stock prices reflect expected risk, that is, expected beta, rather than historical risk or historical beta. Historical betas, whether raw or adjusted, are only surrogates for expected beta. The best of the two surrogates is adjusted beta.

## **2. Standard CAPM**

A myriad of empirical tests of the CAPM have shown that the risk-return tradeoff is not as steeply sloped as that predicted by the CAPM. That is, low-beta securities earn returns somewhat higher than the CAPM would predict, and high-beta securities earn less than predicted. This is one of the most widely known empirical findings of the finance literature. This literature is summarized in Chapter 13 of Dr. Morin's book [Regulatory Finance, Public Utilities Report Inc., Arlington, VA, 1994].

Explanations for these results include the following:

1. The CAPM excludes other variables that are important in determining security returns.
2. The market index used in the tests excludes important classes of securities, such as bonds, mortgages, and business investment.
3. Constraints on investor borrowing exist contrary to the assumption of the CAPM.

Several finance scholars have developed refined and expanded versions of the standard CAPM. These enhanced CAPMs typically produce a risk-return relationship that is flatter than the plain vanilla CAPM prediction. This is exactly what the empirical CAPM contained in Dr. Morin's testimony accomplishes. It produces a risk-return tradeoff that is flatter than the risk-return tradeoff predicted by the standard CAPM, and better approximates the observed relationship between risk and return in capital markets.

The following empirical studies in the finance literature support the notion that the standard CAPM understates the required return for securities with betas less than unity, and overstates the return for securities with betas greater than unity. Since electric utilities have betas less than unity, the standard CAPM produces a downward-biased estimate of the cost of capital for electric utilities.

Friend, I. and Blume, M.E. "The Demand for Risky Assets." *American Economic Review*, Dec. 1975, 900-922.

Black, F., Jensen, M.C., and Scholes, M. "The Capital Asset Pricing Model: Some Empirical Tests." Reprinted in *Studies in the Theory of Capital Markets*, Edited by M.C. Jensen, 79-124. New York: Praeger, 1972.

Blume, M.E. and Friend, I. "A New Look at the Capital Asset Pricing Model." *Journal of Finance*, March 1973, 19-34.

Blume, M.E. and Husic, F. "Price, Beta, and Exchange Listing." *Journal of Finance*, May 1973, 283-299.

Fama, E.F. and Macbeth, J. "Risk, Return, and Equilibrium: Empirical Tests." *Journal of Political Economy*, June 1973, 607-636.

Banz, R.W. "The Relationship Between Return and Market Value of Common Stock." *Journal of Financial Economics*, March 1981, 3-18.

Litzenberger, R. H. and Ramaswamy, K. "The Effect of Personal Taxes and Dividends on Capital Asset Prices: Theory and Empirical Evidence." *Journal of Financial Economics*, June 1979, 163-196.

Litzenberger, R. H., Ramaswamy, K. and Sosin, H. (1980) "On the CAPM Approach to the Estimation of a Public Utility's Cost of Equity Capital, Journal of Finance, 35, May 1980, 369-83.

Kraus, A. and Litzenberger, R.H. (1976) "Skewness Preference and the Valuation of Risk Assets, Journal of Finance, 31, 1085-99.

Friend, I., Westerfield, R., and Granito, M. (1978) "New Evidence on the Capital Asset Pricing Model, Journal of Finance, 23, 903-916.

Morin, R.A. (1981) "Intertemporal Market-Line Theory: An Empirical Test," Financial Review, Proceedings of the Eastern Finance Association, 1981.

The empirical approximation to the CAPM that Dr. Morin utilizes in his testimony is consistent with both theory and empirical evidence, and has the added advantage of computational simplicity. The traditional version of the CAPM is given by the following:

$$K = R_F + \beta(R_M - R_F)$$

As discussed above, the statistical evidence indicates that the risk-return relationship is flatter than that predicted by the CAPM. For example, over the period 1926-1984, the empirical evidence cited in Dr. Morin's book indicates that the expected return on a security is actually given by the following equation:

$$\text{RETURN} = .0829 + .0520 \beta$$

Given that the risk-free rate over the estimation period was approximately 6%, this relationship implies that the intercept of the risk-return relationship is higher than the 6% risk-free rate, contrary to the CAPM's prediction. Given the seminal Ibbotson-Sinquefeld result that the average return on an average risk stock exceeds the risk-free rate by about 8.0% in that period, that is,  $(R_M - R_F) = 8\%$ , the intercept of the observed relationship between return and beta exceeds the risk-free rate by about 2%, or 1/4 of 8%, and the slope of the relationship, .0520, is close to 3/4 of 8%. Therefore, the empirical evidence suggests that the expected return on a security is related to its risk by the following approximation:

$$K = R_F + x (R_M - R_F) + (1-x) \beta (R_M - R_F)$$

where x is a fraction to be determined empirically. The value of x was actually derived by systematically varying the constant "x" in that equation from 0 to 1 in steps of 0.05 and choosing that value of 'x' that minimized the mean square error between the observed relationship,

$$\text{RETURN} = .0829 + .0520 \beta$$

and the empirical shortcut CAPM formula. The value of x that best explained the observed relationship was between 0.25 and 0.30. For reasons of conservatism, I selected the low value of x, 0.25. If x = 0.25, the equation becomes:

$$K = R_F + 0.25 (R_M - R_F) + 0.75 \beta (R_M - R_F)$$

To the best of Dr. Morin's knowledge, most of the aforementioned studies utilize raw betas rather than Value Line adjusted betas. The latter were not available over most of the time periods covered in these studies. Dr. Morin's own empirical investigation of the relationship between return and Value Line adjusted betas is quite consistent with the general findings of the literature cited above. The graph below shows the observed relationship between DCF returns and Value Line adjusted betas that is much flatter than that predicted by the plain vanilla CAPM.

